WHITE PAPER

SMART SOLUTIONS FOR SENSORS

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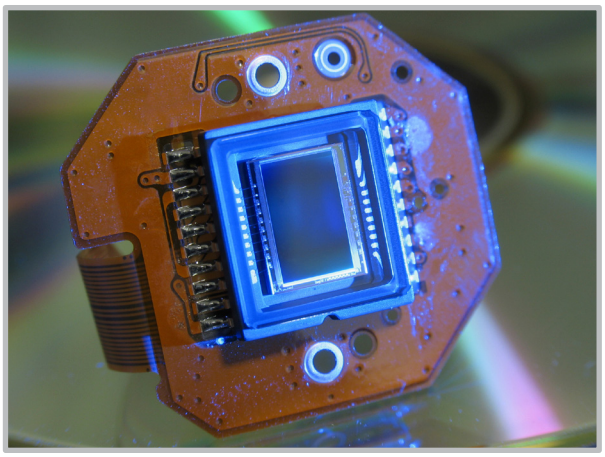
Electronic sensors are the go-to data input device for many industries and tasks. From measuring the airspeed on military drones to patient evaluations performed by medical testing equipment, sensors have become ubiquitous. They represent a market that is growing exponentially due to many developing applications such as self-driving cars and chemical sensing. Many sensors are part of mission-critical systems where they must be protected from adverse operating conditions. Precision sensors are expensive and fragile, and shrinking component design demands that sensors become more intricate and delicate. Engineers are commonly challenged to find a low-cost, manufacturing-friendly method of incorporating sensors into a system that will function in a harsh environment while meeting demanding performance requirements.

Adhesives are critical to sensor assemblies, and can be effective bonding sensors to almost any surface. The right potting compound provides excellent protection without hindering sensing abilities. Ellsworth Adhesives offers customized product design solutions that are scalable and can be integrated into any sensor application. Standard dispensing equipment seamlessly assimilates into common processes, but Ellsworth Adhesives can also adapt equipment for unique applications.

Protecting Vulnerable Sensors

Sensor-based systems are required to be both accurate and sensitive. Therefore, protecting a sensor is imperative to creating a reliable product with accurate readings without compromising instrument sensitivity. This narrow equilibrium is easily upset by poor assembly methods, mechanically constraining hardware, or a hostile environment. Consider tire pressure monitoring systems (TPMS), which utilize pressure sensors to measure the real-time air pressure within an automobile tire. A malfunctioning sensor cannot warn the driver if an unsafe tire condition exists, and as a result puts the safety of the driver and other motorists at risk. If encapsulated with an RF-permeable potting compound, the sensor is protected from vibration, moisture, and temperature changes while still permitting communication with the rest of the TPMS. The right encapsulant is a simple and inexpensive key technology for protecting valuable and potentially life-saving sensors that are otherwise vulnerable to environmental damage. Countless other



applications require a ruggedized sensor which can be facilitated by adhesive compounds, without affecting resolution and other qualities.

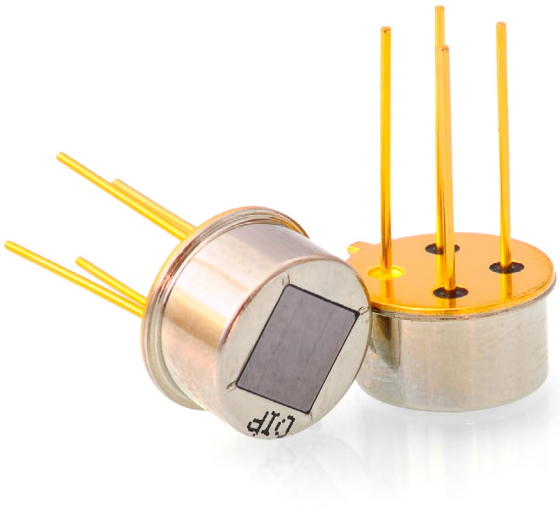
Adhesives simplify assembly processes and in many applications can replace costly or vulnerable hardware. Adhesives commonly replace rivets and welding, and UV-curing or dual-curing compounds can conjoin components almost instantly, reducing assembly times and eliminating costly curing equipment. Replacing fasteners and hardware with a high-strength adhesive bond can increase throughput,

Sensor type	Example application	Protection from	Properties needed
Ultrasonic, Electromagnetic Acoustic Transducer (EMAT)	Position detection in assembly line	Impacts; vibration; contaminants	Acoustically permeable
Load cell	Scales	Thermal expansion; overstrain	Deformation transfer to strain gauge
Turbidity	Water quality testing	Water ingress; oxidation	Optical transmission
Moisture/temperature (wireless)	Determining wet road conditions	Vibration/shock; compression; corrosives (road salt); weather; temperature	Thermally conductive; RF permeance
Inertial	Munitions	Shock; temperature	Disposable (low cost)
Myocardial	Monitor patient temperature changes during heart surgery	Contaminants; fluid ingress	Sterility (adhesive unaffected by biocides)
Airspeed	Aircraft speed	Extreme temperatures; weather	Instrument exposure to air flow

decrease part count and material costs, and simplify product designs. Electrically conductive compounds can replace physical wires in some instances. Some manufacturers seek a single compound to meet all their adhesive needs, but there is usually a better suited and more efficient solution specific to each application.

A common challenge faced by consumer electronics manufacturers is adhering sensors to polypropylene, polyethylene, and polytetrafluoroethylene plastics. The application of certain types of epoxies—typically preceding by a primer, corona treatment, or plasma surface treating process creates reliable adhesion even on low surface energy plastics where other compounds fail, especially when exposed to thermal variances. Ellsworth Adhesives can engineer a solution that works for any sensor application.

Sensor components which generate heat will benefit from a thermally conductive adhesive, which can route excess heat to an outer case or heat sink to protect sensitive equipment. In rare instances the adhesive itself can dissipate heat. Temperature sensors need a thermally conductive adhesive to ensure reliable readings. These types of compounds are filled with a material that matches the thermal expansion rates of the materials around it to prevent delamination from thermal stress.



Innovative and customizable solutions exist as well. Certain pastes with electrically conductive fillers can create a fuse-like compound to protect against over-currents in a circuit. Casting resins can be used instead of individual component and PCB housings. Compounds can be functionally graded or layered to create a laminated composite, with each material imparting its own mechanical, thermal, or electrical properties. For instance, a sensor can be encapsulated with a dielectric resin, upon which a shock-absorbing compound is then overlaid. An RF or EMI shielding adhesive can then be used to create a virtually incorruptible sensor. Similarly, an adhesive solution for RF applications must have a precise dielectric value or system performance may be compromised.

Ellsworth Adhesives Solutions

Finding the right adhesives for your company's sensor applications doesn't need to be a dilemma. Ellsworth Adhesives has been finding individualized adhesive solutions for customers in every industry for more than 40 years. A global network of experienced engineers and representatives means Ellsworth Adhesives can serve any market, evaluating their customer's requirements on-site.

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